Claims:

1. A method of solvent pulping cellulose-containing biomass comprising substantially continuously and sequentially:

a) gradually stepping up the pressure and temperature of particulate, crushed or shredded biomass from substantially atmospheric and ambient to above about 350 psig and above kraft cooking temperature, in a plurality of different stages of increasing pressure and temperature;

b) delignifying the particulate biomass in an aqueous slurry of solvent at a pressure above about 350 psig and a temperature above kraft cooking temperature;

c) simultaneously removing solvent while continuing delignification of the biomass in the slurry, at a pressure above about 350 psig and at a temperature above about 140 deg. C, preferably above about 180 deg. C;

d) substantially instantaneously greatly reducing the pressure of the slurry; and then

e) washing the slurry.

2. A method as recited in claim 1 wherein d) produces flashed solvent, and further comprising f) condensing and reusing the flashed solvent.

3. A method as recited in any preceding claim wherein c) is practiced in at least one pressure diffuser, which is arranged in series when there are more than one pressure diffuser.

4. A method as recited in any preceding claim further comprising

g) providing blow-back protection, upon upset conditions, in the process prior to or intermediate within a).

5. A method as recited in claim 4 wherein g) is practiced by providing a valve capable of withstanding the highest pressure encountered during the practice of a)-e).

6. A method as recited in claim 5 wherein g) is practiced at a location wherein the pressure on one operative side of the valve is at substantially atmospheric pressure.

7. A method as recited in any preceding claim wherein b) and c) are practiced at a temperature between about 180-210 degrees C, and a pressure of between about 350-500 psig.

8. A method as recited in claim 1 wherein the solvent comprises ethanol as the primary active constituent.

9. A method as recited in claim 1 wherein c) is practiced to substantially preclude re-deposition of lignin on the cellulose of the biomass.

10. A method as recited in claim 1 wherein solvent-containing liquor used in b) and c) includes liquor removed from the slurry in a subsequent stage, the removed liquor maintained under substantially the same pressure as in the practice of b) and c).

11. A method as recited in claim 1 wherein the biomass comprises corn stovers.

12. A solvent pulping system for a cellulose containing biomass, comprising:

a) at least one steaming vessel having a first outlet;

b) at least one impregnation vessel operatively connected to the first outlet, and having a second outlet;

c) a blow-back preventing, upon upset conditions, device;

d) a solvent delignification reactor operatively connected to b) and capable of operating at a pressure of 350 psig or more; and

wherein c) is capable of withstanding the operating pressure of d).

13. A system as recited in claim 12 wherein d) has a third outlet, and further comprising at least one pressure diffuser operatively connected to the third outlet.

14. A system as recited in claim 12 further comprising an indirect heater for heating solvent supplied to b).

15. A system as recited in claim 12 further comprising a blow tank operatively connected to the last of the pressure diffusers

16. A system as recited in claim 15 further comprising a relief condenser operatively connected to a gaseous relief from the blow tank.

17. A system as recited in claim 12 wherein d) comprises an upflow or vapor phase reactor.

18. A system as recited in claim 12 wherein b) includes a plug screw feeder or compression screw device.

19. A system as recited in claim 12 wherein the system comprises a plurality of vessels which incrementally raise the pressure of the biomass.

20. A system as recited in claim 12 further comprising a plurality of filtrate tanks maintained at substantially the same operating pressure as d).

21. A system as recited in claim 12 and substantially devoid of a filtrate tank.

22. A system as recited in claim 12 further comprising a nitrogen purge for d).

23. A system as recited in claim 12 further comprising a nitrogen pressure control device.

24. A system as recited in claim 12 further comprising an extraction screen adjacent the third outlet.

25. A system as recited in claim 12 wherein c) comprises a rotary valve capable of withstanding a pressure differential of between about 350-500 psig.

26. A system as recited in claim 25 wherein c) is capable of withstanding a pressure differential of about 450 psig.

27. A solvent pulping system for a cellulose containing biomass, comprising:

a) at least one steaming vessel having a first outlet;

b) at least one super-atmospheric impregnation vessel operatively connected to the first outlet, and having a second outlet;

c) a solvent delignification reactor operatively connected to b) and capable of operating at a pressure of 350 psig or more, and having a third outlet; and

d) a plurality of series connected pressure diffusers operatively connected to the third outlet and operating at 350 psig or more, and optionally

a retention tube downstream of each pressure diffuser to provide sufficient retention time to substantially preclude re-deposition of lignin on the cellulose fibers of the biomass.

28. A system as recited in claim 27 further comprising a plug screw feeder or compression screw device between a) and b); and further comprising a solvent containing line for introducing solvent-containing liquor at the plug screw feeder outlet or compression screw device outlet.

29. A system as recited in claim 27 further comprising an indirect heater for heating solvent supplied to b), a blow tank operatively connected to the last of pressure diffusers, and a relief condenser operatively connected to a gaseous relief from the blow tank.

30. A system as recited in claim 27 wherein c) comprises an upflow or vapor phase reactor, and wherein b) includes a plug screw feeder; and further comprising at least one super-atmospheric steaming vessel operatively connected between a) and b).

31. A system as recited in claim 27 further comprising a plurality of filtrate tanks maintained at substantially the same operating pressure as c).

32. A solvent pulping system for a cellulose containing biomass, comprising:

a) at least one steaming vessel having a first outlet;

b) at least one super-atmospheric impregnation vessel operatively connected to the first outlet, and having a second outlet;

c) a solvent delignification reactor operatively connected to b) and capable of operating at a pressure of 350 psig or more, and having a third outlet; and

wherein b) includes a plug screw feeder and a fluffer at its outlet; and further comprising a solvent containing line for introducing solvent-containing liquor at the plug screw feeder outlet or between the plug screw feeder and fluffer, or in the fluffer.

33. A solvent pulping system for a cellulose containing biomass, comprising:

a) at least one super-atmospheric steaming vessel having a first outlet;

b) at least one super-atmospheric impregnation vessel operatively connected to the first outlet, and having a second outlet;

c) a solvent delignification reactor operatively connected to b) and capable of operating at a pressure of 350 psig or more, and having a third outlet; and

d) a plug screw feeder or compression screw device between a) and b); and

e) a solvent containing line for introducing solvent-containing liquor at the plug screw feeder outlet or compression screw device outlet.

34. A system as recited in claim 33 further comprising at least one series connected pressure diffuser operatively connected to the third outlet and operating at 350 psig or more, and optionally a retention tube downstream of each pressure diffuser to provide sufficient retention time to substantially preclude re-deposition of lignin on the cellulose fibers of the biomass.

35. A system as recited in claim 34 further comprising a blow tank operatively connected to the last of pressure diffusers and retention tubes.

36. A system as recited in claim 34 further comprising vessels for multistage alcohol washing located downstream from the last of pressure diffusers and retention tubes.

37. A system as recited in claim 33 further comprising an indirect heater for heating solvent supplied to b).

38. A system as recited in claim 33 wherein c) is a downflow reactor.

39. A system as recited in claim 33 further comprising a plug screw feeder or compression screw device in advance of a).

40. A system as recited in claim 33 further comprising a blow-back preventing, upon upset conditions, device that is capable of withstanding the operating pressure of c) and is located in advance of a).

41. A method of solvent pulping cellulose-containing biomass comprising substantially continuously and sequentially:

a) steaming the biomass and impregnating it with solvent to produce an aqueous slurry of biomass and solvent;

b) delignifying the particulate biomass in the slurry at a pressure above about 350 psig and a temperature above about 140 degrees C, preferably above about 180 degrees C;

c) simultaneously removing solvent while continuing delignification of the biomass in the slurry, at a pressure above about 350 psig and a temperature above about 180 degrees C in a series of stages, and to substantially preclude re-deposition of lignin on the cellulose of the biomass;

d) substantially instantaneously greatly reducing the pressure of the slurry; and then

e) washing the slurry.

42. A method as recited in claim 41 wherein during b), c) and e) filtrate is removed and held in tanks and then redirected to a stage other than that from which it was removed, and further comprising maintaining the filtrate tanks and connected piping at substantially the same pressure as b) is practiced.

43. A method as recited in claim 41 wherein d) produces flashed solvent, and further comprising f) condensing and reusing the flashed solvent; and further comprising g) providing blow-back protection, upon upset conditions, in the process prior to or intermediate within a), by providing a rotary valve capable of withstanding the highest pressure encountered during the practice of a)-e), and wherein g) is practiced at a location wherein the pressure on one operative side of the rotary vale is at substantially atmospheric pressure.

44. A method as recited in claim 41 further comprising indirectly heating the solvent supplied for impregnating the biomass in a) to a temperature above about 180 degrees C.

45. A method as recited in claim 41 further comprising retaining the slurry after at least one pressure diffuser stage for a time sufficient to substantially prevent re-deposition of lignin on the cellulose fibers of the biomass.

46. A method as recited in claim 41 wherein the liquor to material ratio during delignification is between about 5:1 and 9:1.